



# Formulation and Evaluation of a Brain-Boosting and Stress-Relieving Herbal Chocolate

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## ABSTRACT

This study's goal is to create herbal chocolate with Brahmi, Tulsi and Ashwagandha powder extract. Formulating and testing brain-boosting herbal chocolate that will improve memory was the primary goal of this study. The product known as chocolate is made by combining cocoa powder with fat and then sugar powder to create a solid semifluid. The herbal chocolate mixture is frequently used to improve human memory and brain function. Dark chocolate has several health advantages, including reducing the risk of cardiovascular disease. Dark chocolate has several benefits, such as improving vascular and endothelial function, insulin sensitivity, and antioxidants. In addition to showing good herbal drug release, drug content measurement, and physical stability, the manufactured herbal chocolate formulation was evaluated for overall appearance, PH and stability. By providing a promising product that blends enjoyment with cognitive support, this study adds to the expanding field of functional foods and serves consumers looking for all-encompassing approaches to brain health and wellbeing. New dietary supplements are needed to support brain health because dementia and neurological disorders are becoming more common. The creation and testing of an herbal chocolate that boosts the brain by utilizing the neuroprotective properties of particular medicinal herbs is the main goal of this study.

**Keywords:** Herbal chocolate, Extract of Brahmi Ashwagandha and Tulsi powder, memory enhancing, cocoa butter, Neuroprotective herbs, Formulation, Evaluation.

## INTRODUCTION

Our individuality depends on our memories. Even of situations that we have experienced jointly, what each of us remembers is not exactly the same as what others remember. However, each of us remembers events, facts, passionate feelings, and skills in our unmistakable courses—some for a short period of time, others for a lifetime. Memory is the ability of a person to store information about events, data, and other tangible shocks for brief or extended periods of time and review it later as needed.

In today's focused and upsetting world, poor memory, low maintenance, and moderate review are common problems. Even though we all complain about our memories, they are generally excellent and are only starting to deteriorate due to aging or specific neurological conditions.

Conditions like age, stress, and emotions can lead to memory loss, amnesia, anxiety, high blood pressure, dementia, or more depressing risks like schizophrenia and Alzheimer's disease (AD).[1] Despite the availability of various produced drugs for memory enhancement, their use is limited due to side effects. There has been a rise in recent years due to a justifiable desire for academic institutions and pharmaceutical research facilities to look into the memory-improving benefits of herbs.

Given that chocolate is largely acknowledged by both pediatric and pediatric groups, this study's primary focus was selected. Other health benefits of chocolate include lowering blood pressure, altering blood flow to the brain, preventing cell damage, raising glucose levels, lowering the risk of heart attack, increasing HDL cholesterol, and lowering LDL cholesterol. In keeping with this, the current investigation article focuses on the design and evaluation of the nutrient-dense chocolate tonics that contain ashwagandha Brahmi and tulsi enhancing impact without causing any reaction.



**Fig 1: Herbal Chocolate**

Herbal chocolate that improves brain function is assessed using a range of techniques, including as physicochemical analysis, bioavailability testing, and assessments of cognitive function. Particle distribution, fat content, humidity, and other physicochemical parameters are evaluated to ensure product stability and quality. Research on bioavailability aims to shed light on the absorption and metabolism of significant bioactive compounds, providing insights into how well they function to produce cognitive benefits.[3]

Furthermore, cognitive assessments carried out through in vitro and in vivo studies offer significant new insights into the potential of the chocolate. Furthermore, cognitive assessments carried out in vitro and in vivo offer significant new insights into the potential of the chocolate. advantages for enhancing memory, attention, and executive function. Cell culture models offer a platform for investigating the neuroprotective qualities of herbal compounds against oxidative damage and neurodegeneration. Research on animals that evaluates the impact of chocolate on behavior and cognitive function in vivo supports these findings.

As people's concerns about memory loss and neurodegenerative diseases grow, so does the need for natural cognitive enhancers. The goal of this project is to create and evaluate a herbal chocolate that boosts the brain by combining dark chocolate with traditional herbal that Utilizing cocoa's inherent antioxidant qualities and commercial appeal, it is used as a delivery medium.

We believe that combining these herbs with chocolate will enhance cognitive performance in addition to being enjoyable, offering a novel approach to brain health support.[4]

➤ **ADVANTAGES**

- A comprehensive strategy for brain health.
- Ensures product safety
- Dual benefit: Cognitive enhancement + stress relief
- Natural ingredients: Reduced reliance on synthetic supplements
- Improved compliance: Chocolate as a delivery medium is more palatable

➤ **DISADVANTAGES**

- Individual differences in effectiveness.
- Possible allergenicity: Some users may react to herbs or chocolate
- Herb-chocolate interaction: Might alter taste or reduce bioavailability
- Dosing challenges: Precise standardization of herbal extracts is crucial
- Cost: Premium ingredients increase production cost
- Complicated regulations [5]

- **PLANT PROFILE**

### 1 Tulsi

Tulsi (also spelled Tulasi or Tulshi) is a revered plant in Ayurveda and traditional Indian medicine. Biologically, it is classified as follows:



**Fig 2. Tulsi**

**Kingdom:** Plantae

**Class:** Angiosperms, Eudicots, Asterids

**Order:** Lamiales

**Family:** Lamiaceae (Mint family)

**Genus:** Ocimum

- **Biological name:**

*Ocimum tenuiflorum* (also called *Ocimum sanctum*) — Holy Basil or Krishna Tulsi

*Ocimum gratissimum* — sometimes referred to as Vana Tulsi

*Ocimum basilicum* — Sweet Basil, different from traditional tulsi

- **Types of Tulsi** (Common Varieties):

1. Rama Tulsi (*Ocimum sanctum* – green leaves)
2. Krishna Tulsi (*Ocimum sanctum* – purple leaves)
3. Vana Tulsi (*Ocimum gratissimum* – wild variety, taller, more aromatic)

- **Pharmacology activity:**

Tulsi (also spelled Tulasi or Thulasi), scientifically known as *Ocimum sanctum* or *Ocimum tenuiflorum*, is a medicinal plant widely used in traditional Ayurvedic medicine. It exhibits a variety of pharmacological activities due to its rich composition of essential oils, flavonoids, and other phytochemicals.

1. **Adaptogenic (anti-stress) activity:** Tulsi helps the body adapt to stress and promotes mental balance. It modulates cortisol levels and supports the adrenal system.
2. **Antioxidant:** Contains compounds like eugenol, rosmarinic acid, and apigenin that scavenge free radicals and reduce oxidative stress.
3. **Anti-inflammatory:** Tulsi reduces inflammation by inhibiting the release of pro-inflammatory cytokines and enzymes like COX-2.
4. **Antimicrobial:** Effective against a range of bacteria (e.g., *E. coli*, *Staph. aureus*), viruses (including cold viruses), fungi, and protozoa.
5. **Hepatoprotective:** Protects the liver from toxins and supports liver function.
6. **Cardioprotective:** Helps in lowering blood cholesterol and blood pressure, and reduces the risk of heart diseases.
7. **Anti-diabetic:** Helps in reducing blood glucose levels and improving insulin sensitivity.[6]

## 2. Ashwagandha



**Fig. 3 Ashwagandha**

- **Biological Classification:**

**Kingdom:** Plantae

**Biological name:** *Withania somnifera*

**Subkingdom:** Tracheobionta (Vascular plants)

**Superdivision:** Spermatophyta (Seed plants)

**Division:** Magnoliophyta (Flowering plants)

**Class:** Magnoliopsida (Dicotyledons)

**Subclass:** Asteridae

**Order:** Solanales

**Family:** Solanaceae (Nightshade family)

**Genus:** *Withania*

**Species:** *Withania somnifera* (L.) Dunal

- **Pharmacological Activities:**

**1. Adaptogenic / Anti-stress:** Helps the body resist physiological and psychological stress. Reduces cortisol levels and modulates stress response pathways.

**2. Antioxidant:** Neutralizes free radicals. Protects against oxidative stress-related diseases.

**3. Anti-inflammatory:** Inhibits pro-inflammatory cytokines (like TNF- $\alpha$ , IL-6). Useful in arthritis and chronic inflammatory conditions

**4. Neuroprotective / Nootropic:** Enhances memory, cognition, and learning. Promotes regeneration of nerve cells and synapses. Shown to be effective in neurodegenerative conditions like Alzheimer's and Parkinson's.

**5. Anxiolytic & Antidepressant:** Acts on GABAergic pathways. Reduces anxiety and depression-like symptoms.

**6. Immunomodulatory:** Modulates immune system responses. Enhances cellular and humoral immunity.

**7. Anticancer:** Withaferin A and withanolides show cytotoxic effects on cancer cells. Induces apoptosis and inhibits angiogenesis in tumors.

**8. Endocrine Effects:** Balances thyroid hormones. Supports adrenal function and testosterone levels.[7]

### 3 . Brahmi:



**Fig 4. Brahmi**

**Biological name:** Bacopa monnieri

**Kingdom:** Plantae

**Class:** Angiosperms, Eudicots, Asterids

**Order:** Lamiales

**Family:** Plantaginaceae (previously Scrophulariaceae)

**Genus:** Bacopa

**Species:** Bacopa monnieri

- **Pharmacology activity:** Bharmi (Brahmi), also known as Bacopa monnieri, is a well-known herb in traditional medicine, particularly in Ayurvedic practices. It has several pharmacological activities that contribute to its health benefits. Here are the key pharmacological activities of Brahmi (Bharmi):

**1. Cognitive Enhancement and Neuroprotective Effects:** Memory Improvement: Brahmi is known to enhance cognitive functions, particularly memory. It is believed to work by increasing the levels of certain neurotransmitters like acetylcholine, which plays a role in memory and learning. Neuroprotection: It contains compounds such as bacosides, which help protect nerve cells from damage and oxidative stress, supporting overall brain health. Anti-Alzheimer's Effects: Some studies have shown Brahmi's potential in improving symptoms of Alzheimer's disease by reducing beta-amyloid plaques in the brain and enhancing cognitive performance.

**2. Antioxidant Activity:** Brahmi has strong antioxidant properties due to its flavonoids and alkaloids. These help combat oxidative stress, which is a factor in aging and various diseases, including neurological disorders.

**3. Anti-Anxiety and Stress Reduction:** Adaptogenic Properties: Brahmi is known to reduce stress by enhancing the body's resistance to stress and improving resilience. It helps reduce anxiety, which is often attributed to its ability to regulate the levels of certain stress-related hormones like cortisol. Anti-Depressant Effects: Research suggests Brahmi has mood-stabilizing properties and can act as a natural antidepressant by modulating the serotonin levels in the brain.

**4. Anti-Inflammatory Activity:** Brahmi has anti-inflammatory properties, which help in reducing inflammation in the body.

**5. Adaptogenic Effects:** Improves Resistance to Stress: Brahmi is considered an adaptogen, meaning it helps the body adapt to physical, emotional, and environmental stress. It promotes overall well-being and vitality.

**6. Anti-depressant Effects:** Some studies suggest that Brahmi may act as a mild antidepressant by enhancing serotonin levels in the brain, which could help in managing mild depression and improving mood.



**7. Antimicrobial and Anti-bacterial Properties:** Brahmi has been shown to have antimicrobial properties, which makes it useful in treating infections and boosting overall immune function.

**8. Cardioprotective Effects:** Brahmi also demonstrates potential benefits for heart health by improving blood circulation and reducing the risk factors for cardiovascular diseases, such as high blood pressure and cholesterol

**9. Anti-cancer Properties:** Early studies suggest that Brahmi may have potential anti-cancer effects due to its ability to inhibit the growth of cancer cells and induce apoptosis (cell death) in tumor cells.

**10. Anti-epileptic Activity:** Some studies have indicated that Brahmi may have anti-epileptic effects, helping to control seizures and support neurological health.[8]

## MATERIALS AND METHOD

- Preparation of chocolate
  - Collect cocoa butter, sugar, and the herbal extract of selects
  - Melt Cocoa Butter
  - Using a double boiler, thoroughly heat the cocoa butter at low heat.
  - Add Sugar
  - Slowly whisk in the sugar until it dissolves completely after adding it to the melting cocoa butter.
  - Combine Herbal Extract
  - Include the herbal extract in the blend. The extract's potency and the strength , achieve will determine how much
  - Stir in the powdered. This serves as a preservative in addition to offering a nutritional boost.
  - To improve the flavour, stir with cardamom powder. Taste and adjust the amount accordingly.
  - Pour into Molds
  - After the mixture is well-blended and smooth, pour it into moulds made of chocolate.
  - Chill and set, depending on how soon you want the chocolate to firm, you may let it chill and set at ambient temperature or place it in refrigerator.
  - Remove from Moulds
  - After the chocolates have set, carefully take them out of the moulds.
  - Store Appropriately, to preserve freshness, keep the herbal chocolate in a sealed container in a cold.
- **INSTRUMENTS-** Heating Mentle, Freezer, Digital pH Meter
- **EQUIPMENTS-** Volumetric flask, Beaker, Glass rod, Funnel, Tripod Stand, Whatamen Filter paper, Chocolate Mould.
- **MATERIALS:** Stevia Sugar, Cocoa Powder, Cardamom Powder, Dark compound, Cocoa butter, Brahmi powder, Ashwagandha Powder & Tulsi Powder purchased.

## METHOD

• **Extraction of Herbal Powder:** The Extraction was done by Aqueous Extraction process first the powdered plant material of Bramhi, Ashwagandha and Tulsi were with mixture aqueous solution dissolved in solvent for 24 hours the solvent was subjected filtration and then extract of Ashwagandha tulsi and bramhi were Collected.





**Fig. 5 Extraction Process**

#### **Aqueous Extraction Procedure:**

We are using three herbal powders for aqueous extraction process as follow:

Take 1gm of tulsi powdered Herb, 1gm of Brahmi powdered Herb, 1gm of Ashwagandha powdered Herb in a Beaker. After that we are adding 30 ml of water (10ml per herb) and Heat at 60-80°C for 2-3 hours using a water bath (avoid boiling). Stir occasionally. Cool, filter through muslin cloth or Whatman No.1 filter paper. Repeat extraction 2 times with fresh water. Take 1ml of liquid extract of each Herb in the preparation Total extraction time: 6-8 hours (including repetitions)

#### **Preparation of Herbal Chocolate:**

**Table No.1**

Ingredients	Quantity
Stevia Sugar	3-4 gm
Cardamom Powder	0.5 gm
Cocoa Powder	8 gm
Cocoa Butter	30 gm
Dark Compund	20 gm
Ashwagandha liquid extract	1 ml
Tulsi liquid extract	1 ml
Brahmi liquid extract	1 ml

### Preparation of Herbal Chocolate Steps:

- 1. Melt Base Ingredients:** In a double boiler, melt cocoa butter and dark compound chocolate until smooth. Stir gently and do not overheat (keep below 45°C).
- 2. Mix in Cocoa Powder & Stevia:** Add cocoa powder, whisk until smooth. Add stevia, stir to dissolve completely. Taste and adjust sweetness if needed.
- 3. Add flavouring agent:** Stir in cardamom powder for aroma, Optional, Add herbal extracts smoothly.
- 4. Cool Slightly & Add Herbal Extracts:** Let the mix cool slightly (around 35-40°C). Stir in ashwagandha, brahmi, and tulsi liquid extracts. Mix thoroughly and gently.
- 5. Mold the Chocolates:** Pour into 10-piece silicone chocolate mold.
- 6. Set & Store:** Refrigerate for 30-40 minutes until set. Unmold and store in a cool, dry place.



**Fig.6 Herbal Chocolate**

- **Evaluation Test of herbal chocolate:**

**1.Organoleptic properties:** These are Sensory properties. Those that can be detected by the sense organs. For foods, it is used particularly of the combination of taste, texture, and astringency and aroma (perceived in the nose). We are studying organoleptic properties of Herbal chocolate as follow: The colour of Herbal Chocolate its Brown colour, were Carefully evaluated to ensure a consistent and appealing product, The odour of Herbal Chocolate is Pleasant, Taste of Herbal Chocolate Slightly sweet along with smooth and pleasant mouth feel is their and Appearance of Herbal chocolate is Glossy etc.

**2. PH of herbal chocolate:**

The pH formulation was determined using Digita pH Meter



**Fig. 7 pH test**



**3. Weight Variation:** It is a Standard quality control method used to ensure uniformity of Herbal Chocolates. The weight of six Chocolate pieces was weighed separately and collectively. The weight of all Chocolates was used to calculate the average weight. The average weight was then Compared with the individual weight using the following formula to determine % Deviation.

#### 4. Chemical test

##### Test for Carbohydrates

- **Fehling Test:** To 1ml solution was boiled on water bath with 1ml each Fehling solution A and B
- **Benedict's Test:** To 1ml of solution add 2 drops Benedict's reagent.
- **Molisch Test:** To 1ml of solution add 2 drops of alpha- naphthol and 1ml of con. Sulphuric acid slowly alongside of the test tube.



**Fig. 12 Chemical Test**

**5. Test for proteins:** Take 3 ml of Chocolate Formulation add 4% NaOH and few drop of 1% copper sulphate solution

**6. Test for Amino acid:** 3ml solution heated add 3 drops of 5% ninhydrin in water boil for 10 minutes.

#### 7. Stability Test

Any product's formulation and preparation would be lacking without adequate stability studies of the final product. Accelerated stability studies, which involve subjecting the product to elevated temperatures in accordance with ICH guidelines, are a general method for predicting the stability of any product. For the prepared formulation, a short-term accelerated stability study was conducted over a period of three months.

### RESULT AND DICUSSION

- **Result:**

The formulation and evaluation of herbal chocolate was successfully performed. The best formulation according to colour odour test and organoleptic properties this study was carried out to determine the physicochemical properties of chocolate based on colour, pH, moisture content and stability. The sensory evaluation of the chocolate was analyzed at immediately after processing and at one month's storage.

• **Organoleptic Evaluation**

Sr.No	Test	F1	F2	F3	F4	F5	F6
1	Colour	Brown	Brown	Brown	Brown	Brown	Brown
2	Texture	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth
3	Taste	Slightly Sweet	Slightly Sweet	Slightly Sweet	Slightly Sweet	Slightly Sweet	Slightly Sweet
4	Consistency	Solid	Solid	Solid	Solid	Solid	Solid
5	pH	7.2	7.3	7.1	7.3	7.1	7.2
6	Stability	Stable	Stable	Stable	Stable	Stable	Stable
7	Aroma test	Pleasant	Pleasant	Pleasant	Pleasant	Pleasant	Pleasant

- **Colour :** A consistent brown colour was displayed by the Chocolate Formulation (F1 ,F2 F3, F4, F5 and F6) suggesting consistency in the chocolate preparation procedure.
- 1. **Texture:** Every formulation displayed a smooth texture, indicating that the ingredients had been properly blended and homogenized.
- 2. **Taste:** All of the chocolates' flavours (F1, F2, F3, F4 ,F5 and F6 ) were consistently sweet, suggesting that the sweetness levels were balanced.
- 3. **Consistency:** The chocolates' solid consistency showed that they had properly solidified during the cooling process.
- 4. **pH:** The formulations' pH values fall within a narrow range (7.1 to 7.3) suggesting a small fluctuation in the overall stability of acidity levels.
- 5. **Shelf Life Test :** The shelf life of each formulation was evaluated at room temperature, indicating possible stability under storage conditions.
- 6. **Aroma Test:** The chocolates exhibited a slightly sweet and pleasant aroma enhancing the sensory experience of consumers.

❖ **Weight variation**

$$\text{Formula - Individual weight- Average weight} \times 100$$

$$\text{Average weigh}$$

1. = 4.49 - 5.08/5.08×100 = - 11.61      2. = 5.28 - 5.08/5.08×100 = 3.93  
 3. = 5.51 - 5.08/5.08×100 = 8.46      4. = 5.54 - 5.08/5.08×100 = 9.05  
 5. = 4.98 - 5.08/5.08×100 = -1.96      6. = 4.71 - 5.08/5.08×100 = -7.28

Formulation No	F1	F2	F3	F4	F5	F6
Individual Weight of piece of Chocolate	4.49g	5.28g	5.51g	5.54g	4.98g	7.28g

❖ **Chemical Test**

Sr. No	Test of Extract	Observation	Indication
1	Test of Carbohydrates ❖ Fehling test ❖ Benedicts test ❖ Molisch Test	1. Brick Red ppt 2. Brick Red ppt 3. Violet ring at the junction between two liquids	Presence of carbohydrates
2	Test for Protein	Violet Colour	Presence of Protein
3	Test for amino acid	Bluish colour	presence of amino acid

❖ **Stability Test**

Parameter	Storage condition	At the time of preparation	After the one month	After
Colour, Odour, Taste, Mouth feel, Appearance	2 - 8 <sup>0</sup> C	Smooth, Glossy, Chocolaty	No Change	No Change

### DISCUSSION

Formulation success and challenges, the effectiveness of the chosen herbs and cocoa components in achieving the intended cognitive benefits. Sensory and physical properties, analyze sensory evaluation results to determine consumer acceptability based on the taste, aroma, texture, and appearance. Nutritional content and health benefits, present findings from nutritional analysis, emphasizing the product's health benefits. Stability of the products stability under different storage conditions and its shelf-life implication. The concept of Combining Functional Foods, such as Chocolates with Herbal ingredients that provide Cognitive Benefits and reduce stress has become increasingly popular in recent years. This Combination leverages the well-known neuroprotective properties of certain herbs while capitalizing on the mood-enhancing effects of Chocolate. Below is an in-depth discussion on the Formulation and evaluation of brain-boosting and Stress-relieving herbal Chocolate

### CONCLUSION & SUMMARY

The creation and assessment of herbal chocolate that boosts the brain offer a viable approach to improving mental abilities through dietary treatments. By including herbal extracts cocoabutter, chocolate-based goods might potentially deliver real cognitive advantages in addition to satisfying cravings. The examined research has provided insight into a number of areas related to this discipline, including formulation techniques and the assessment of the bioavailability stability, and effectiveness. From the above result, it can be concluded that the provides sweetening property as compare to others, pH & stability profile to be satisfactory. Herbal extracts of brahmi powder and ashwagandha powder were successfully



formulated in the chocolate formulations and contain the active constituents extract are rich many micronutrients that are important for brain function, including copper, iron, magnesium and zinc, used for brain boosting and sugar metabolism and also improve stress condition. The flavonoids in chocolate may help protect the brain. Studies have suggested that eating chocolate, especially dark chocolate, could boost both memory and mood. The Organoleptic properties of chocolate are excellent for masking unpleasant flavour's associated with some active agents and imparting a smooth and creamy texture to compositions of active agents. Thus, chocolate formulation provides a palatable means for delivering medicaments through oral delivery. The drugs extracts, which are used in the dose range are safe consumption and can be swallowed without any risk of side effects.

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